"VIRTUAL QUIZ": A TOOL FOR ACTIVE LEARNING AND ASSESSMENT IN CLINICAL ANATOMY

M. Ribeiro[1] M. Amaral[2], H. Ribeiro[2], J. Machado[1], A. Povo[1], M. Severo[1], M. A. Ferreira[1]

1 Faculty of Medicine of University of Porto
Porto, Portugal
anatclin@med.up.pt

2 Office of Support for New Technologies in Education of University of Porto
Porto, Portugal
gatiup@reit.up.pt

The imaging and sectional anatomy "Virtual Quiz" Identification Station, a Clinical Anatomy tool created in 2007/2008 academic year, in the ambit of the Clinical Anatomy Curricular Unit (2nd year/2nd semester) of the Medical Course in the Faculty of Medicine of the University of Porto (FMUP) gives specific training for real assessment of anatomical structures. Integrated in WebCT Vista, it consists of an animation, built in Adobe Flash 8, which includes, randomly, 40 images of a total of 2500. The importance of the "Virtual Quiz" was confirmed by the students' results in the Clinical Anatomy practical examination. The ones who had used this tool succeeded in getting a much better performance than the ones who had not used it. In fact, the "Virtual Quiz" showed to be of major importance for the teaching/learning programs of Anatomy in our Medical Course.

Keywords **-** Virtual Quiz; Clinical anatomy; Identification station; e-learning

1 INTRODUCTION

Introduced in different medical curricula all over the world, Clinical Anatomy, being a new approach of teaching/learning human anatomy, is considered highly relevant for future physicians, as it allows to integrate basic anatomical knowledge to clinical activity developed by health professionals [1].

Clinical Anatomy, recognized as a strong foundation of clinical medicine, has the purpose of providing solid anatomical background, reinforcing the significance of functional and living anatomy, normal variation, three-dimensional relationships and imaging applied to medical practice, in order to meet the emerging challenges of clinical practice. In addition, helping to develop the essential critical thinking [2], identified as crucial to the acquisition of clinical reasoning, this area of knowledge contributes to linking basic and clinical areas in Medical Education [3, 4]. It aims to make sure that students start their clinical training with the anatomy knowledge, essential to the physical examination of patients, diseases' diagnosis and some clinical procedures.

Anatomy education helps the students to understand the three-dimensional (3-D) dynamic structure of the human living body, in order to manage to apply quickly appropriate cognitive skills to clinical problems whenever it is necessary [1, 5, 6]. In order to interpret radiological and sectional anatomy material in current medical practice, these cognitive skills are essential. Anatomy is the biomedical discipline that has benefited the most from the new technologies regarding the visualization and knowledge representation [7, 8, 9].

Last years have been marked by computer science evolution that has created new learning and teaching opportunities. In fact, despite the heavy tradition in classical pedagogical methods, the use of online materials in support of medical schools courses has become common.

Considering the importance of promoting self-directed active learning attitudes in medical students [10, 11, 12, 13] and the fact that computer technology in education is more and more adopted, the imaging and sectional Anatomy Identification Station - "Virtual Quiz" - allows the improvement of the acquisition of a correct "anatomical reasoning" by medical students.

Considering the context of the Bologna process, this new teaching resource was developed in the ambit of the Clinical Anatomy Curricular Unit of the Medical Course in the Faculty of Medicine of the

University of Porto (FMUP), supported by the Office of Support for New Technologies in Education and integrated in the WebCT Vista.

The students that were attending Clinical Anatomy (2^{nd} year/2^{nd} semester) during 2007/2008 academic year benefited from this learning object.

The syllabus of Clinical Anatomy before Bologna Process was supported online by tools and materials that were not so interactive. The learning content management system was used as a repository and not in is full pedagogical potential. [14, 15].

Virtual tools allows a specific imaging and sectional anatomy training that promotes the development of not only active learning but also training for practical assessment of identification of anatomical structures, which is very important for medical students. It will lead to a high quality and excellence in the learning process of the area of Medical Education and to the achievement of the anatomical competence, which is essential for the clinical reasoning [16].

These are the following purposes:

(i) to actively follow the teaching/learning process;

(ii) to stimulate the use of electronic resources;

(iii) to promote interactivity between the teaching staff and students;

(iv) to provide training of specific competencies;

(v) to provide objectivity in the identification of anatomical structures with immediate feed-back;

(vi) to improve academic success;

(vii) to transfer knowledge to other educational scenarios (Medical Schools in African Portuguese Speaking Countries – EDULINK Project).

2 METHODS

To create the “Virtual Quiz”, it was used human dissected material and body sections belonging to the Institute of Anatomy of the Faculty of Medicine of the University of Porto, as well as imaging material used for practical sessions (x-rays, cross-sectional CT scans and MRIs). A few authorized photos of sectional anatomy were also used.

The e-learning platforms, as well as pedagogical and technological support, were assured by the Office of Support for New Technologies in Education of University of Porto.

The “Virtual Quiz” consists of an animation, built in Adobe Flash 8, which includes, randomly, 40 images of a total of 2500. To each one of these images (labelled structure) there is a correct answer. The student has a minute to answer each set of 2 images. Then, a sound is heard (similar to the sound the students hear during their “real” practical examination) and the page advances automatically to the following set of images. After viewing and identifying the 40 anatomical structures the result appears and the student can check his/her answers and compare them with the correct ones (immediate feed-back).

This tool, being exported to a SCORM package, allows the transposition of the final grade to the Learning Management System (LMS); the teachers have access to individualized information as well as to the integration of the grading board of the LMS that contains the global performance of the student in all the online activities through the course. As the “Virtual Quiz” is a instrument that can work dissociated from a LMS, it can be used online and offline.

The “Virtual Quiz” exists in two versions: the first one including only head and neck, and the final one including the total units of the program: head/neck, thorax, abdomen, pelvis/perineum, back and limbs.

It is now in production the pelvis/perineum mini-“Virtual Quiz” to be used in a course for Medical training in Africa as a result of a cooperation programme established with Angola and Mozambique Universities.

3 RESULTS

The online platform was consulted by 272 students from 304 registered, which corresponds to 89,5%, most of them having used it at home, through their personal computers. They have medium level skills in informatics and they usually deal with the computer for research subjects, participation in forum sessions, chats and e-mails. The qualitative analysis of questionnaires assessing satisfaction levels were very positive, considering the online component support performance in Clinical Anatomy, although the level of interactivity between student/teacher has to be improved.

Taking as reference the students who have performed the final exam in Clinical Anatomy, 44.3% performed the first version of the “Virtual Quiz” Identification Station (head and neck) and 73.2% have performed at least once the final version of the “Virtual Quiz” Identification Station.

It has been demonstrated a positive association between the number of sessions and the classification obtained in the practical assessment (identification of structures) (rho=0,23, p<0,001).

Comparing the results obtained by the students who completed the first version of the “Virtual Quiz” Identification Station with those who did not, it was demonstrated that the first obtained higher classifications in the practical examination. (15,0 vs 14,1, p=0,014).

No differences were found in the assessment of the theoretical exam (12,0 vs 12,3, p=0,314).

When the comparison was made with students performing the final version of the “Virtual Quiz” with those who did not performed, the same situation was demonstrated. (14,7 vs 13,9, p=0,040) (Fig. 1).

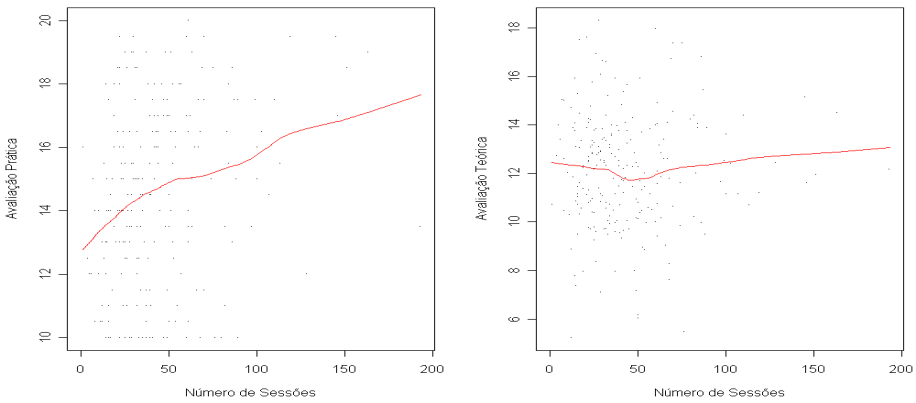

Fig. 1 – Number of sessions and grading of the practical (left) and theoretical exam (right).

4 DISCUSSION AND CONCLUSIONS

Through this work, like other approaches in introducing new technologies in programs of Anatomy in Medical Education [9, 12, 13], the adequacy and importance of developing new tools is demonstrated – fitting real education situations and in the scope of teaching/learning situations – even in a field that offers a lot of materials. The students consider that the “Virtual Quiz” is a very important tool, since it promotes active learning and its feedback is quickly available. Another point is that it has the advantage of being extremely flexible to be used in other learning contexts and also to be offered to Master and PhD programs that include identification of anatomical structures. Linking these important issues to the proved correlation with improvement of academic performance, we can confirm that this instrument is a valuable resource in the teaching/learning programs of the Medical Course.

The development of this tool is part of a holistic strategy in Clinical Anatomy pedagogical approach [14, 15, 17], which can foresee new changes in the curricular development of the Medical Course.

The effective use of this instrument can be exported to other educational contexts, where identification of anatomical structures is included in the learning process. There is the example of the cooperation

projects with Medical Schools of Portuguese speaking countries, as the recently awarded EDULINK Project “A NAME for Health”.

The e-learning@UP project promotes a National and International network between the teaching staff interested in Information and Communication Technologies applied to the educational process. In this context, a background has been created to develop new tools like “Virtual Quiz” identification station, which is used not only as a complement to the learning process but also as assessment training station and, in a near future, as an assessment device.

The materials were increasingly improved, specially in terms of e-learning potentialities, in order to deal with educational pressures imposed with a view to the development of the required “anatomical thinking”, which depends on:

(i) pressure from clinical departments towards the need of solid anatomical competencies;

(ii) the evidence that clinical competencies have to be achieved early in the medical course;

(iii) the stimuli induced by introducing clinical scenarios in the first years of medical education towards the acquisition of medical expertise;

(iv) as a means of attracting clinical professional to teach this basic science [1, 18].

The academic year 2007/2008 was marked by the great challenge of the creation of a tool to be used in a virtual environment to support students in the identification of anatomical structures, which is part of the evaluation process of Clinical Anatomy. The original anatomical dissections, as well as the imaging material used in the practical sessions, were provided by the Institute of Anatomy. Students evaluated the “Virtual Quiz” Identification Station, assumed as a “Virtual Training Station”, useful in a view to the acquisition of competencies, in order to develop clinical reasoning since the beginning of the Medical Course [10]. Besides, this will guarantee that medical students are able to identify anatomical structures when they start the clinical training, in order to deal with the new technological challenges.

5 REFERENCES

[1] Educational Affairs Committee, A.A.C.A., Clinical Anatomy 9, 71 (1996).

[2] W. Carr and S. Kemmis, Becoming Critical. Education, Knowledge and Action Research. (The Falmer Press, London, 1986).

[3] A. Wojtczak and M.R. Schwarz, Medical Teacher 22, 555 (2000).

[4] M.R. Schwarz and A. Wojtczak, Medical Teacher 24, 125 (2002).

[5] D.R. Cahill, Clinical Anatomy 6, 116 (1993).

[6] T.J. Collins, C.E. Given, C.E. Hulsebosch and B.T. Miller, Clinical Anatomy 7, 275 (1994).

[7] D.M. Conley, K.G. Kastella, J.W. Sundsten, W. Rauschning and C. Rosse, Clin Anat 5, 185 (1992).

[8] M.S. Gordon, S.B. Issenberg, J.W. Mayer, J.M. Felner, Medical Teacher 21, 32 (1999).

[9] C. Rosse, Academic Medicine 70, 499 (1995).

[10] C. Rosse, American Journal of Anatomy 136, 389 (1973).

[11] H. Jastrow, L. Vollrath, Clinical Anatomy 16, 44 (2003).

[12] H. Jastrow and A. Hollinderbăumer, Anatomical Record 280, 20 (2004).

[13] R. Vázquez, J.M. Riesco, J.A. Juanes, E. Blanco, M. Rubio and J. Carretero, European Journal Anatomy 11, 31 (2007).

[14] M.A.F. Tavares, J.D. Machado and M.C. Silva, Educação Médica 9, 86 (1998).

[15] M.A.F. Tavares, J. Dinis-Machado and M.C. Silva, Surgical Radiological Anatomy 22, 29 (2000).

[16] J.E.F. Fitzgerald, M.J. White, S.W. Tang, C.A. Maxwell-Armstrong and D.K. James, Clinical Anatomy 21, 718 (2008).

[17] M.A. Tavares and M.C. Silva, Clinical Anatomy 12, 337 (1999).

[18] R.M. Harden, M.H. Davis and Crosby J.R., Medical Education 31, 264 (1997)